THE DEVONIAN STRATA OF THE ALTO PASS QUADRANGLE

CHARLES FERNANDO BASSETT, UNIVERSITY OF ILLINOIS

Acknowledgment.

The material used in this paper was collected during the summer of 1923 by Professor T. E. Savage and the writer for the State Geological Survey report on the Alto Pass quadrangle. Many thanks are due Professor Savage for helpful suggestions made in the working up of this material and for permission to publish this paper.

Location of the Alto Pass quadrangle.

The Alto Pass quadrangle is located in the southwestern part of the state bordering the Mississippi River, and includes parts of both Jackson and Union counties, as shown in Fig. I.

Location of the Devonian area.

The area of Devonian rocks covers about 40 square miles in the southwest portion of the quadrangle. These rocks extend from Wolf Lake north to Rattlesnake Ferry, forming the east bluff of the Mississippi River valley. From Rattlesnake Ferry southeast to about a mile northeast of the Gregory school the area is bounded on the north by a fault-plane which brings the middle Devonian in contact with the upper Mississippian rocks. From Gregory school southeast to Walnut Grove church, and thence south to the edge of the quadrangle, the upper Devonian strata dip regularly eastward beneath lower Mississippian strata.

Structure.

In general the formations dip gently eastward at an angle of 3 to 4 degrees, which varies locally. The strata are gently undulating from north to south. In addition to the large fault bordering the Devonian area at the north, there are many small faults in this area, only a few of which can be shown on the map.

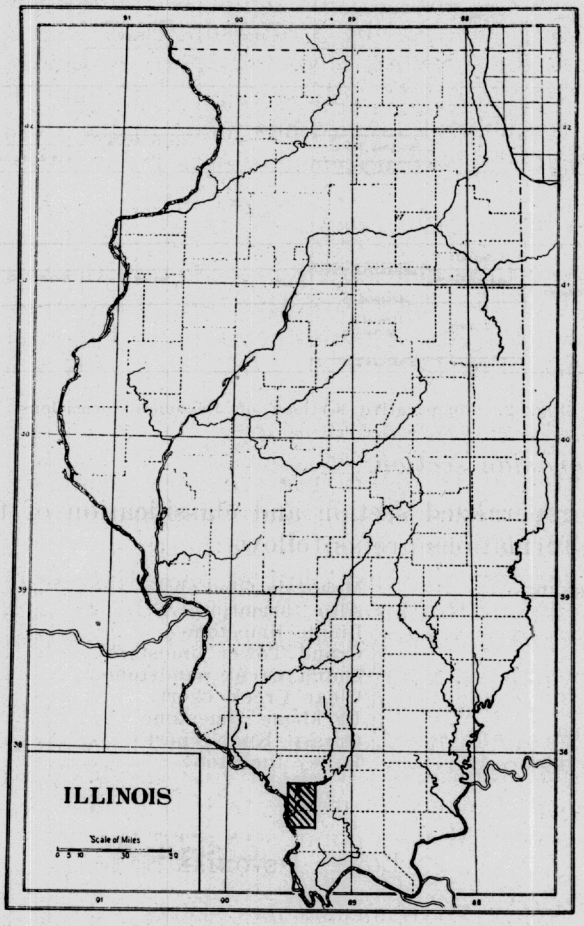

Fig. 1. Map showing the location of the Alto Pass quadrangle.

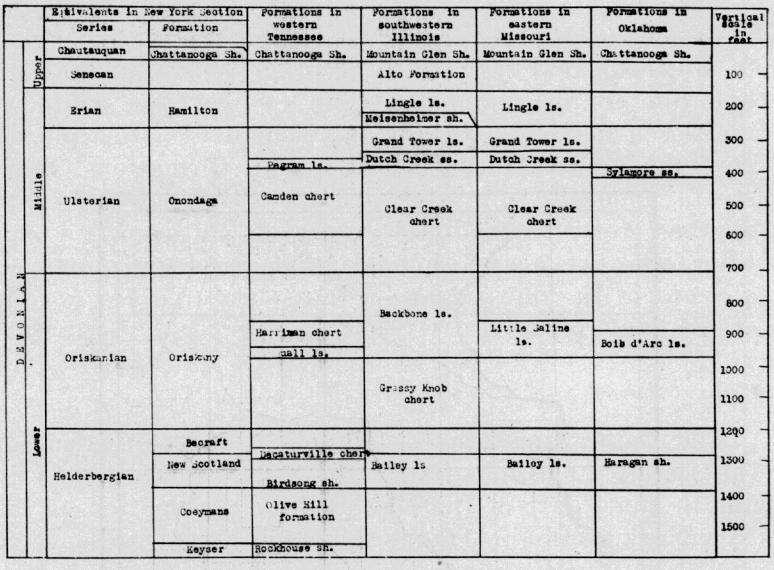

Fig. 2. Comparative sections of Devonian formations.

The Devonian section.

The generalized section and classification of the Devonian formations are as follows:

Chautauquan	Mountain Glen shale.....	20- 40 ft.
Senecan	Alto formation	80±
Erian	Lingle limestone	75- 90±
Ulsterian	Grand Tower limestone.....	60- 75
	Dutch Creek sandstone.....	6- 10
	Clear Creek chert.....	300±
Oriskanian	Backbone limestone	250±
	Grassy Knob chert.....	200±
Helderbergian	Bailey limestone	160
		1205±

Lower Devonian

HELDERBERGIAN SERIES

Bailey limestone.

The Bailey limestone is a dark gray, fine-grained, cherty and shaly limestone which occurs in thin, irregular layers, 2 to 8 inches thick, interbedded with somewhat thinner layers of chert.

This limestone is exposed almost continuously in the bluff of the Mississippi River, from Wolf Lake north to Rattlesnake Ferry, to an average height of 80 feet, but, due to the undulating character of the strata, it reaches a maximum height of 160 feet in a few places. In common with the other Devonian formations, these strata generally dip eastward at an angle of 3 to 4 degrees, except immediately south of Rattlesnake Ferry where the rocks are inclined 19 degrees due north as a result of the down drag on the south or upthrow side of the fault plane.

Correlation.

The Bailey limestone of Illinois is the equivalent of the Bailey limestone in Missouri, and corresponds in age to some part of the New Scotland formation of the New York section[1]. This is indicated by the presence of such fossil species as *Chonostrophia helderbergia, Dalmanella perelegans,* and *Leptaenisca concava.* This limestone can also be correlated with the Birdsong shale of Tennessee and with the Haragan shale of Oklahoma on the basis of its fossil content.

ORISKANIAN SERIES

Grassy Knob Chert.

The Grassy Knob Chert was named by T. E. Savage from the Grassy Knob exposure near Rattlesnake Ferry. This chert may be seen resting unconformably on the Bailey limestone in the Mississippi river bluff south of Rattlesnake Ferry, where it dips 19 degrees north above the Bailey limestone. The thickness of this chert formation is almost 225 feet. It consists of very rough-surfaced, hackley, thick-bedded, gray to reddish-brown chert, in layers 12 to 48 inches thick, the layers becoming thinner towards the top where they change to rather even bedded, whitish, iron-stained layers, 4 to 8 inches thick. The Grassy Knob chert has been recognized at no place in Illinois outside the Alto Pass quadrangle.

[1]Savage, T. E. Am. Jour. Sci., Vol. XLIX, p. 173, March, 1920.

Correlation.

Only three species of fossils have been recognized from this chert, namely, *Anoplotheca flabellites, Orthotetes pandora,* and *Spirifer murchisoni.* None of these is definitely diagnostic of Oriskany age. However, since none of these species occurs in rocks older than the Oriskany, and since rocks of undoubted Oriskany age immediately overlie the chert from which they came, the Oriskany age of the chert is thus indirectly established. This chert seems to be closely allied to the overlying Backbone (Oriskany) limestone into which it passes by a rather gradual transition. There is no chert horizon of Oriskany age underlying the calcareous beds containing *Spirifer arenosus* either in western Tennessee or in Ste. Genevieve county, Missouri; hence this chert can not be directly correlated with any strata in either the Tennessee or Missouri localities.

Backbone Limestone.

The Backbone limestone is usually a rather coarse-grained, light gray to white, sub-crystalline limestone in layers ranging in thickness from 1 to 6 inches up to more massive layers nearly 15 feet thick. In the middle part the thin limestone layers alternate with thin, irregular bands of chert, 1 to 4 inches thick, which make the rock resemble the Bailey limestone, except that the Backbone limestone is generally white, less shaly, and more crystalline. Exposures of the Backbone (Oriskany) limestone are not known in the state outside of this area.

The Backbone limestone lies conformably on the Grassy Knob chert as in seen in exposures along the northwest branch of Hudgen's Creek, where the chert passes upward into a thin-bedded sandy limestone with chert bands in the lower part, as shown in Figure 3.

Correlation.

The fossils of the Backbone limestone are very large and abundant only in the lower massive layers a short distance above the chert. They become very scarce and

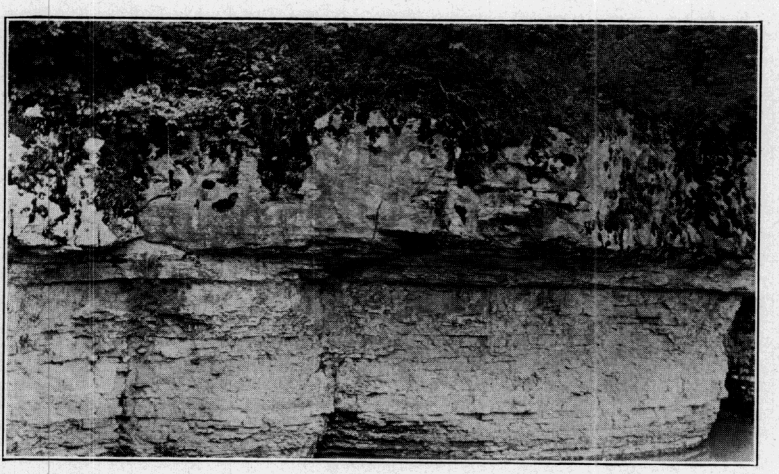

Fig. 3. Exposure of massive Backbone (Oriskany) limestone containing *Spirifer arenosus* overlying the thinner, sandy and cherty beds below.

mostly small in size thruout the greater part of the formation. This Backbone (Oriskany) limestone is the limestone which Savage[2] described from north of Grand Tower as apparently being related to the Becraft of the New York section. However, at that locality as at many other localitites in this area only the upper strata are exposed, and the typical Oriskany fossils are not present. Only a few small poorly preserved shells are usually obtainable from the upper portion of the formation. The fossils from the exposure on Hudgen's Creek and at Rattlesnake Ferry show that the Backbone limestone is of Oriskany age, and that it is the equivalent of the Little Saline limestone of St. Genevieve county, Missouri. The Backbone limestone corresponds to the Harriman chert and Quall limestone formations of Tennessee, and the Bois d'Arc limestone of Oklahoma. It also corresponds to the upper Oriskany strata of New York and Maryland, as shown by the presence in it of such fossils as *Beachia ovalis, B. suessana, Leptostrophia magnifica, Plethorhyncha barrandi, Rensselaria marylandica,* and *Spirifer arenosus.*

Middle Devonian

ULSTERIAN SERIES

Clear Creek Chert.

The Clear Creek chert occurs usually as a thin-bedded, slightly ironstained, gray chert. In places in the upper part there is a crystalline limestone alternating with chert layers, and in the lower part there usually occur layers of chert 10 to 12 inches or more thick. It is not uncommon to find lenses or layers of chert 2 to 6 inches thick interbedded with the limestone.

In the northwest portion of the Devonian area this chert rests unconformably on the Backbone (Oriskany) limestone. If the Grassy Knob chert is present in the southwest portion it has not been differentiated from the Clear Creek chert on account of the absence of the Backbone limestone between these chert formations, the lithologic similarity of the Clear Creek chert with the upper

[2]Op. cit., p. 173.

portion of the Grassy Knob chert, and the general absence of fossils.

Towards the top of Bald Knob, near the east side of this area, and at a considerably higher altitude than most of the exposures, the layers of chert become more massive, ranging from 18 to 48 inches thick. These layers are white and smooth like novaculite, and do not have the iron-stained appearance of the higher, thinner layers.

Correlation.

The Clear Creek chert has been placed by Savage[3] in the basal portion of the Onondaga of the New York section on the basis of its fossil content. The diagnostic species on which this correlation is based are *Chonostrophia reversa, Spirifer cf. divaricatus, S. duodendarius,* and *Dalmanites calypso.* This chert is the equivalent of the Clear Creek chert of Missouri[4] and has been correlated with the Camden chert of Tennessee[5]. The Sylamore sandstone of Oklahoma represents deposition of the same time as the Camden chert of Tennessee and hence is similar in age to the Clear Creek chert.

Dutch Creek Sandstone.

The Dutch Creek sandstone is a coarse grained, iron-stained, brown sandstone, loosely cemented in some places and firmly cemented in others. The formation reaches a maximum thickness of 10 feet in the Alto Pass quadrangle, but farther south in the Jonesboro quadrangle its thickness reaches 25 feet. It rests conformably on the Clear Creek chert as is seen in an outcrop in the Jonesboro quadrangle a short distance south of this area, where the sandstone and chert are interbedded.

Correlation.

In places the Dutch Creek sandstone is seen to grade up into the overlying Grand Tower limestone without an apparent sedimentary break. The stratigraphic

3Op. cit., p. 174.
4Op. cit., p. 174.
5Schuchert, Chas. Bul. Geol. Soc. Amer., vol. 33, p. 668, Nov. 2, 1922.

position of this sandstone and such species of fossils as *Spirifer duodendarius, S. macrothyris,* and *Odontocephalus aegeria* indicates the Onondagan age of the formation.

Grand Tower Limestone.

The Grand Tower limestone is a rather pure, granular to subcrystalline limestone, light to dark gray in color. It occurs in layers 3 to 6 inches thick, which rest conformably on the Dutch Creek sandstone. The latter in places passes upward with a gradual transition into the limestone.

Correlation.

The species of fossils named below clearly indicate this formation to be equivalent to the Grand Tower limestone of the Missouri section, and that it corresponds to the Onondaga limestone of New York: *Spirifer acuminatus, S. gregarius, S. macrothyris, S. segmentum, Stropheodonta patersoni, Odontocephalus aegeria.*

ERIAN SERIES.

Lingle Limestone.

The Lingle limestone is a hard, brittle, dark colored to black, coarse to fine grained limestone in layers 4 to 20 inches thick. It rests unconformably on the Grand Tower limestone. In places the Lingle limestone is somewhat shaly and is in thin layers which are light brown in color, and contain any shells of *Spirifer audaculus.*

Correlation.

The faunal content of this limestone proves that it corresponds to the Hamilton of the New York section, the following species being diagnostic of both formations: *Athyris spiriferoides, Chonetes coronatus, C. pusillus, C. vicinius, Spirifer audaculus, S. granulosus, Tropidoleptus carinatus,* and *Aviculopecten princeps.* The Lingle limestone is the equivalent also of the St. Laurent limestone of the Missouri section and of the Sellersburg formation of Indiana.

Upper Devonian

SENECAN SERIES

Alto Formation.

The Alto formation is a thin-bedded, rough, cherty and shaly, brown, silicious limestone which rests unconformably on the Lingle limestone.

Correlation.

This formation is thought to represent about the time of deposition of the Portage deposits of the New York section[6]. However, the fossil content is not diagnostic of any particular division of the upper Devonian, and no closer correlation is attempted. Some of the more common fossils are *Chonetes scitulus, Cryptonella eudora,* and *Leiorhynchus mesacostalis.*

CHAUTAUQUAN SERIES

Mountain Glen Shale.

The Mountain Glen shale is a hard, black, laminated shale, in which pyrite is common along the bedding planes and especially at the base. This formation is exposed in the same localities as the Alto formation on which it rests unconformably.

Correlation.

Savage[7] tentatively correlates this formation with the upper part of the New Albany black shale of Indiana and the Chattanooga black shale of Tennessee. The "Chattanooga" black shale of Oklahoma overlying the Sylamore sandstone may also be equivalent to this formation. It is recognized that this formation may properly belong in the basal Mississippian.

6Savage, T. E. Op. cit., p. 177.
7Op. cit., p. 177.